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NUCLEAR REGULATORY COMMISSION

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BRIEFING ON THE APPLICATION OF
THE SEVERE ACCIDENT POLICY TO THE LEAD
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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Tuesday, June 20, 1989

The Commission met in open session, pursuant to notice, at 10:00 a.m., Lando W. Zech, Jr., Chairman, presiding.

COMMISSIONERS PRESENT:

LANDO W. ZECH, JR., Chairman of the Commission
THOMAS M. ROBERTS, Commissioner
KENNETH M. CARR, Commissioner
KENNETH C. ROGERS, Commissioner
JAMES R. CURTISS, Commissioner

STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary
WILLIAM C. PARLER, General Counsel
DR. THOMAS MURLEY
LESTER RUBENSTEIN
CHARLES MILLER
THEMIS SPEIS
JAMES TAYLOR
ASHOK THADANI
DINO SCALETTI

P-R-O-C-E-E-D-I-N-G-S 10:08 a.m.

CHAIRMAN ZECH: Good morning, ladies and gentlemen. This morning the NRC staff will brief the Commission on the application of the Commission's Severe Accident Policy to the lead advance light water reactor for design certification, General Electric's advance boiling water reactor. This is an information briefing and no formal Commission vote is planned for this meeting.

I understand that copies of the slides to be used during the presentation are available as you enter the meeting room.

Do any of my fellow Commissioners have any comments before we begin?

Mr. Taylor, before we begin then, let me welcome you and the staff and in particular note that Mr. Rubenstein, who is here with us today, is going to be retiring soon. He'll be joining me. And I know that you've been very mindful of the public service of trust and confidence that our country has placed in you and the public service you've given after 30 years, I understand, and we want to specifically thank you for that significant public service and for your service to our agency and for our country.

MR. RUBENSTEIN: Thank you, sir.

CHAIRMAN ZECH: Mr. Taylor, you may proceed.

MR. TAYLOR: Good morning, sir. Dr. Murley will introduce the topic and the staff will then give a detailed briefing.

CHAIRMAN ZECH: Thank you very much. You may proceed.

DR. MURLEY: Mr. Chairman, this briefing today, I think, represents a major step forward in the Commission's standardization policy. We are essentially on the schedule that we established over two years ago on the advanced boiling water reactor and there have been three, I would say, significant licensing milestones during that period so far for the ABWR, and this is the third.

The first one was the licensing review basis document. This was issued in August of 1987. It set the guidelines on how we, the staff, were going to review the application because we knew we were entering unchartered territory to some extent. This was a GE initiative; they wanted such a licensing review basis document. We agreed with them and it has held up very well. It's guided the staff, I think, quite well the last two years. We're encouraging other applicants, as a matter of fact, to work with us on a licensing review basis document for their

plants as well.

The second major licensing step was last January when we described to the Commission how the staff proposes to treat what I would call traditional safety issues, like design basis accidents, fire protection, technical specifications and those sorts of things. The staff and GE were in agreement on those issues and we are proceeding on the basis that we outlined for the Commission.

Today we're going to describe how the staff proposes to handle severe accident issues in the ABWR review. This is a thorny issue, as you know, and rather than let the issues bubble up to the top from staff reviews, which has been the traditional method of review for new plants, we've tried to define the policy issues early and develop resolutions. And that's what we're bringing to the Commission today for discussion.

We've had many meetings with the staff. I took my senior staff out to San Jose in March for a two day meeting where we discussed these issues and GE and the staff are in general agreement on the issues we're going to discuss today. There are still, of course, some design details that we have yet to settle; things like leakage control system for MSIVs,

charcoal filter bit questions and those sorts of things. I do not regard those as major policy issues, but rather the normal kinds of design details that the staff reviews and settles. So with this policy guidance in place, then the staff reviews can move ahead over the next year.

Let me talk about schedules for a moment. We expect to be able to issue what I would call final draft SER next spring. We'll be issuing SER chapters as we go along. But this final draft would be something that we would go to the ACRS with and expect a letter from the ACRS. We will be and have been working with the ACRS all along, but prior to beginning the hearing process, we would expect to have this final draft next spring.

We would then put out a final SER and an FDA, which is a final design approval, next summer. With that in place, we would then begin the hearing process in late summer of 1990. That hearing process would then, we expect, take about 14 months leading up to certification of the ABWR in October of 1991. That has been the schedule that we've been adhering to and, as I said, with these policies guidance in place we see no impediment to meeting those schedule. It, of course, depends on GE sending the material to us on

time and it depends on no major diversions of the staff. Again, I don't see any problem with either of those.

GE and others have spent some $250 million on the design and development of the ABWR and the design is in quite good shape and staff review can proceed.

With that introduction then, Les Rubenstein will discuss the severe accident guidelines that we've worked out.

CHAIRMAN ZECH: Thank you very much. You may proceed.

MR. RUBENSTEIN: Good morning.

I'm going to start with the second view graph. The first view graph states the purpose of our meeting, which the Chairman and Dr. Murley have both stated quite directly. And as Dr. Murley said, I'm going to discuss some specific features of the ABWR design and their relationship to severe accident phenomena.

The topics of discussion are grouped into three general parts. The first grouping, station blackout, Intersystem LOCA and ATWAS, really deal with phenomena which are substantial initiators of core melt sequences. And we'll discuss these specifically

in terms of the ABWR design features which address them and which, I might say, address them satisfactorily.

The second group deal with severe accident phenomena, particularly as they affect containment performance, design and the management of core debris and core cooling -- pardon me, debris cooling.

And the third list of items are some miscellaneous subjects which will be prominent during the review and preparation of the final design approval and the design certification rulemaking itself.

The second group on view graph three deal with design goal for the containment and the plant itself, hydrogen control venting and core debris coolability. And as I said before, the miscellaneous groups range from source term through to BWR thermal-hydraulic stability.

If I might have the fourth view graph. As we've stated a couple of times this morning, we're addressing the phenomena on a design specific basis. And on the first group, the first item I'm going to address is station blackout.

At the outset I would say that the design goes beyond the station blackout rule and it is sized such that the plant can be brought to a shutdown with

one train. This is accomplished through three independent electrical divisions and three 100 percent capacity diesel generators. In addition to the diesel generators which deal with the design basis accidents, there is also an alternate AC combustion turbine generator to deal with the internal events and as a backup to the design basis emergency diesel generators. This is an off-the-shelf type item with a very quick start.

The station blackout design also has robustness which is reflected in a ten hour blackout period survivability during which period one can use the RCIC and station batteries. And this would allow one time to restore station power.

In the unlikely event that station power were not restored, it also has an AC independent water addition system which relies on fire protection equipment.

DR. MURLEY: I should mention, Mr. Chairman, the RCIC is the reactor core isolation cooling system, and that's the one you use when the isolation valves have bottled up the reactor and so you cool the core by using water from the pool. It's an important safety system.

CHAIRMAN ZECH: Yes. Thank you.

MR. RUBENSTEIN: Well, on the next view graph, 5, it's our conclusion regarding station blackout preliminary to final review the staff believes that with these features we will have a sufficiently lower risk of station blackout compared to the previous BWR designs.

If there's no question about station blackout, I'll move along to the second phenomena which the ABWR addresses on dealing with intersystem LOCA. Here there was clearly a need and a capability of eliminating concern of a LOCA outside the containment. And the goal was such that with high confidence that the probability of an interfacing LOCA, which will lead to an unisolable LOCA outside of containment was very low. We wanted to fix this problem, we wanted to make it go away through the design and GE did this. And to do that they put on a testable capability for the ECCS in-board check valves with position indication in the control room. In addition, the ABWR low pressure systems are adequately protected from reactor coolant system pressure. This means their design standards for the piping are such that it would require a number of malfunctions before the low pressure piping would see system pressure and they, in and of themselves, would be designed to--

where they're tied to the primary system to be capable of accommodating system pressure. System pressure is about 1,000 PSI.

With these features that the ABWR has, the staff is confident that the potential threat of an intersystem LOCA is resolved for the ABWR.

Can I have view graph 7, please? In regards to the ATWS rule, 10 C.F.R. 50.62 the G.E. design has a number of interesting features. They've gone to both hydraulic and electrical rod control run-ins. They have a recirculation pump trip capability. They've done away with the old SCRAM discharge volume system which gave us quite a bit of trouble in years past. And they have a --

COMMISSIONER CARR: Just out of curiosity, how did they do that?

MR. RUBENSTEIN: Well, they've gone basically to the dual hydraulic, which is a water backed up nitrogen system and the mechanical system on live run-in.

COMMISSIONER CARR: Okay. I'll look into it further.

MR. RUBENSTEIN: They have offered a manual standby liquid control system. The ATWS rule stipulates automatic. The staff has asked GE to do a

reliability analysis to confirm acceptability. And if it is found acceptable, we will recommend an exemption from the ATWS rule for this. Thus, in effect, the ATWS rule will be satisfied.

COMMISSIONER ROGERS: Well, will we set our own criteria for that acceptability?

MR. RUBENSTEIN: We have not yet, but this is early in the review part.

DR. MURLEY: I should add that we have required and requested GE to submit a reliability analysis to us. That reliability analysis is to justify that manual SLCS is acceptable. Based on that review, then that will be the basis that we agree or disagree on. We haven't yet accepted it.

CHAIRMAN ZECH: Do we know that anyone has a fully automatic standby liquid control system?

DR. MURLEY: Well, the current designs now are automatic and the -- maybe I'd better, before I get in too deep, let Ashok Thadani tell the details.

CHAIRMAN ZECH: All right. Fine. Please identify yourself to the reporter, please?

MR. THADANI: I'm Ashok Thadani, NRR staff.

There's only one plant today that has automatic standby liquid control system, and that's Limerick, Unit 1. And the rule, the ATWS rule, did

not require automatic standby liquid control systems for any plants except those that went into operation after, I believe, it was 1986. But I may be off on the year.

And if I might also address the other question that was raised in terms of the SCRAM discharge volume as to where the discharge goes, it goes in the reactor vessel itself.

CHAIRMAN ZECH: All right. Thank you very much.

MR. RUBENSTEIN: Moving on to view graph number 8. We're now getting into the second grouping of design features, Moving from the initiators of core melt sequences to some of the more containment performance oriented design features.

As you may recall from our discussions with you about the progress on EPRI and previously on General Electric's design, that the EPRI requirements document has a goal of ten to minus five core melt frequency and it has a public safety goal for a significant site boundary release, that is an off-site dose release of 25 REM at a half mile of ten to the minus six probability.

As Dr. Murley said, previously GE and the staff in the licensing review basis document also

addressed a containment design goal of performance. And this was a conditional containment failure probability of ten to the minus one over credible core damage sequences.

These conditions apply to that definition of ten to the minus one. We define containment failure as an uncontrolled release of fission products from the containment and we assume in the analysis, or General Electric assumes that the sequence starts with the onset of core damage. In effect, we keep the debris in the containment. And with these three design goals resulting in these specific design features of the ABWR, that is design goals of ten to the minus five core melt frequency, ten to the minus one conditional containment failure probability and ten to the minus six significant site boundary release, we believe that the design offers a balanced accident prevention and mitigation capability and will achieve defense in depth for the plant. So we've dealt with the initiators of the accidents, the severe accidents. We have a containment performance goal and we have a value which is more conservative than the health objectives of the safety goal.

So we believe with that driving some of the design features of the containment and severe

accident, we have a balanced approach.

Specifically some specifics of near accident phenomena and the ABWR design features are hydrogen control. As you may recall from 10 C.F.R. Part 52 and its predecessor 5034(f) that the design would have to accommodate 100 percent metal water reaction and a less than a 55 percent uniform hydrogen concentration. Well, the ABWR design deals with this by inerting the containment with a nitrogen atmosphere. In addition, it has a hydrogen recombiner capability. And with these features we believe that the hydrogen control features of the ABWR design are acceptable.

View graph 10, please. To provide containment over pressure protection, that is containment pressure integrity for the ABWR, General Electric has proposed an additional feature which is a "hardened" wetwell air space vent which would allow venting to the stack at a controlled release rate and would be emitted at an elevated value above the plant.

This vent operation would be AC independent. That is, only direct current and pneumatic pressure would be required for closure of the two vent valves which are in series with the vent and which are normally open. It includes a rupture disk, which is set slightly above the containment ultimate rupture

strength and the vent itself would allow a reasonable amount of time to restore long term containment cooling without major failure.

Some of the designs of this detail are still being worked out, but it would include something like a 12 or 14 inch diameter piping.

COMMISSIONER CARR: What controls the release rate then? A venturi, the size of the pipe or--

MR. RUBENSTEIN: Size of the pipe.

COMMISSIONER CARR: Size of pipe.

DR. MURLEY: Commissioner, we may still be needing to review some details on that. For example, I haven't seen what the release rate is, so it could very well be that you may want to put a venturi in the line or something.

COMMISSIONER CARR: Two valves and a rupture disk doesn't give you a lot of control normally.

MR. RUBENSTEIN: However, it is sized to take out about three percent decay ~~that~~ heat -- and this would be equivalent to 1RHR train.

Moving on to view graph 11, which is an item in addition to hydrogen control, the containment over pressure protection, which the ABWR design addresses, is core debris coolability. The suppression pool is

physically between the debris, which would be in a lowered dry well, and the containment liner. And this would deal with the containment liner degradation problem. In effect, it would provide a physical barrier between the lower dry well and the liner.

In addition, the design is also constructed in such a way to enhance core debris coolability. It has a passive lower dry well flooding capability, which is provided by fusible plugs between the suppression pool and the lower dry well. We don't have all the details on this, but it would be something where between five and ten roughly four inch plugs which would melt at about 500 degrees fahrenheit and provide water from the suppression pool and flood the lower dry well.

In addition to provide limiting suppression pool fission product bypass, if the vessel did melt through and in that unlikely event, there would be a controlled pathway for the debris. It basically assumes that the water quenches the debris and would provide some fission product scrubbing capability. It would also cool the gases and to make sure that there's no back flow, the vents would be covered by water throughout the course of the accident. Some of these details await further study and discussion with

the staff. But on view graph 12 we come to the conclusion that we really do not expect containment failure by melt through of the base mat or the liner.

There's a fair amount of work to be done on some of the details of this, but we're optimistic that it will work out in a positive way.

Now, getting into the third grouping of more miscellaneous items, as regards the source term and considerations, we're really dealing with two separate applications of source term. The first one was with our normal Part 100 citing requirements and the second one how we're going to calculate the GE or the EPRI large release safety goal.

In the case of the first one, the licensing basis continues to be 10 C.F.R. Part 100 citing criteria with its associated source term as they're represented in TID 14844. Now, to meet this GE needs a little credit for certain design features which are under discussion with the staff. Dr. Murley mentioned those before, it's the MSIV leakage. They need probably 140 or 150 standard cubic feet per hour. This is in contrast to maybe 11 1/2 standard cubic feet per hour in the Tech specs. They need some credit for steam line condenser hold up fission products and for in containment iodine removal. And

we're optimistic that in discussions with the staff that these proposals will be acceptable.

Now, for the more realistic source term that they will use to demonstrate that they meet their safety-goal, the 25-REM 1/2 mile-one in a million probability of exceedance, we would consider departures from the assumptions of Part 100 and allow a realistic assumptions regarding fission product behavior. And --

COMMISSIONER CARR: More realistic means more realistic than we're using.

MR. RUBENSTEIN: Well, best estimate and calculations and hold up and much more database in terms of particulate matter, stuff like that.

COMMISSIONER CARR: So it's a departure from the licensing basis then?

MR. RUBENSTEIN: Yes, it clearly is, sir.

COMMISSIONER CURTISS: Why are we using-- in January the staff apprised us that you were concerned with the licensing basis and it wasn't consistent with the current knowledge that we have, TID 14844 This looks to be the first time where the staff is proposing to use a source term for licensing basis that essentially reflects old knowledge and a different source term for evaluating beyond DBA type

activities or safety goal compliance.

I guess I have two questions. One, if there is, in fact, more realistic information, more accurate information that we've acquired in the source term that is reflected in the source term code package, why don't we use that across the board for both DBA and severe accident? And two, if not, what's the basis for using two different source terms?

DR. MURLEY: I think I can address that, Commissioner. The answer is actually fairly simple. That is, we would have to have a rule change to change the source term. And we embarked on that path some years ago and we found, in fact, in order to support the type of certainty that we'd need for a rule change, there was not uniform agreement in the technical and scientific community. And so we do not have a revised rule that takes into account all the most recent data with general agreement in the scientific community.

COMMISSIONER ROBERTS: Isn't that still an objective?

DR. MURLEY: Yes. But we thought we'd --

COMMISSIONER ROBERTS: I understand. I understand.

DR. MURLEY: -- approach that in a different

way this time. Rather than delay all of our standardization activities until we can get a rule change, we decided to move ahead this way. We believe it is not a penalty, a big penalty for the design. And so we're moving ahead with Part 100 with TID 14844 source term for the citing licensing basis.

COMMISSIONER CURTISS: It's not clear to me whether you're saying that we are using the existing TID for licensing basis because there isn't the consensus necessary to support a rule change or whether there's some other reason that has lead to that response.

DR. MURLEY: Well, we know it's conservative.

COMMISSIONER CURTISS: Remember, the design certification itself is going to be a rulemaking.

DR. MURLEY: Yes.

COMMISSIONER CURTISS: It won't amend the current rule, but if it's a procedural question as to the defensibility of that change in rulemaking, we are using a new source term in the context of a rulemaking to certify the GE ABWR.

DR. MURLEY: Yes. What we're doing, Commissioner, is we'll be using the old standard, tried and true, TID 14844 source term, which we are

confident is conservative for citing purposes. Now, there is another criterion which is not one of our regulations. It is an industry criterion, which is that the dose during an accident, the dose at a half mile from the plant should be no more than 25 REM whole body with a probability of ten to the minus sixth per reactor year. I got that correct?

MR. RUBENSTEIN: Yes, it is.

DR. MURLEY: Now, that is not our regulation, but it's their criterion and we've more or less adopted it as, yes, that's a good criterion to be using. It is that criterion where we will discuss with GE and with the industry more realistic source terms.

Now, insofar as it's a basis, I haven't thought about that, whether it becomes a part of the basis upon which we license the plant and therefore becomes part of the rule itself? I guess we'd have to chat with somebody from the General Counsel's office.

COMMISSIONER CURTISS: I guess I'm touching on a procedural question. It's an issue of timing or legal defensibility, narrow concern with rulemaking that seems to me that we've got a rulemaking here underway or contemplated culminating in 1990 or '91 that will, in fact result in use of the new source

term information for evaluating this plant. I don't disagree that the current source term information is tried and true, or maybe put a little more accurately, it's tried and not quite true. It's not consistent with the current knowledge is the question I have. I'm not disagreeing with the use of the source term for beyond DBA type activities in this context. My only question is, is there also a basis given what the staff has said in January about the inconsistency of the current source term with current knowledge for applying that same realistic source term uniformly for DBA and beyond DBA?

DR. MURLEY: Now it's one thing to say that, namely that current knowledge has shown that the old source term is conservative. But it's another thing to have something firm to take its place and can withstand rulemaking. We faced up to that some years ago and we concluded that the science was not in place to support a rulemaking. Now, whether we have concluded differently today, I don't know that we have. Would Themis Speis would like to answer this?

COMMISSIONER CURTISS: We have for severe accidents, in this context.

MR. SPEIS: Yes, I would like to add one thing; that even though we're using the same source

term as far as the source term that you introduce into the containment, you know, the 25 percent iodine, we have made two changes within the design basis of the LOCA which current information supports. And those changes involve the credit that you give to the suppression pool for cleaning up some fission products and also to the behavior of iodine insofar as this praise in PWR. So we have moved, even though we have moved slowly, but we still have moved in some areas within the design base.

COMMISSIONER CURTISS: I'd like to pursue, but I won't hold up the briefing. Why don't we go ahead.

COMMISSIONER CARR: When do you expect the data to begin change the source term, bring it up to date?

COMMISSIONER CURTISS: That's my point, it's in now for severe accidents. That's what this paper is saying.

MS. SPEIS: See, the source term is a complicated issue because it's tied to containment performance. For example, the source term that has been used now, the 25 percent iodine, is not far out of line if you have early containment failure. So it's a very complication that it's tied to the whole

severe accident issue. It's a conflict of how we close severe accident issue and then we have to go back and see what changes we make to the source term which addresses the design basis type of considerations.

COMMISSIONER CURTISS: Well, there are severe --

COMMISSIONER CARR: If that was an answer to my question, I missed it.

COMMISSIONER CURTISS: Well, there are severe accident considerations that in new Reg 1150 need to be resolved, Commissioner. But from what I understand, the source term code package, that part of new Reg 1150 is essentially complete and gives us enough confidence to say that for advanced reactors in the severe accident arena we have sufficient information that will in turn have to be defended in the context of a rulemaking to use that source term information. What I am pressing you all to address is the question of whether if all of that is true, and recognizing the complexities that new Reg 1150 poses for that purpose, isn't it also true that source term, that that source term revision could equally well be used for DBA considerations, design basis, licensing basis?

Since I don't want to pursue it here, it is a question I have about --

MR. TAYLOR: I think we may write up a paper and address this for you. Why don't we do that?

DR. MURLEY: I think the Commission needs a separate briefing on the source term thing. But I don't want to leave the impression that we're very close to having a uniform agreement on a new source term for licensing, because I don't think we are. I personally have not seen what's in 1150, for example, and I don't think many on my staff, if any, have either. So I'd certainly want to take a look at that. I think it deserves a special -- we'll do that.

MR. RUBENSTEIN: I would add in another dimension in terms of the ABWR and the severe accident source term, that's a proposed industrial investment protection public safety goal ten to the minus six and it is substantively more stringent than our own health objectives of the safety goal. So while we haven't adopted that in any sense as a requirement we have, in effect, said you propose this, we're very interested and see how you meet this goal yourself. We've had discussions with all the vendor designers in EPRI regarding this and we're not ready to adopt it, nor should we probably adopt it as a requirement. So in

that kind of a discussion where you know you have a substantial amount of margin over our requirements, it makes the dialogue on severe accident source term features more relaxed.

CHAIRMAN ZECH: Can we proceed?

MR. RUBENSTEIN: View graph 15, as the Commissioners may remember, 10 C.F.R. 52 required that all future plants do a probabilistic risk assessment. This would include both internal and external events in the PRA. And in addition to that requirement, in discussions with General Electric and the other members of industry, we have also asked that they provide a reliability and maintenance criteria to ensure that the as-built design and the assumptions regarding the components and systems used in the PRA be maintained throughout the life of the plant. They're addressing this and it's a very difficult question. GE and NUMARC are addressing it, perhaps, on a different schedule and at the same time with each other and they're working on it. So I can't really say much more about this at this time, except that we find it's important throughout the life of the plant to make sure that the key assumptions and commitments of the PRA are maintained.

COMMISSIONER ROGERS: How were you assessing

that and reviewing that PRA? Are we doing that currently ourselves or using contractors?

MR. RUBENSTEIN: Research has got the main review force and they're using Brookhaven National Labs.

COMMISSIONER CARR: When does GE say they're going to provide the reliability of maintenance criteria?

MR. RUBENSTEIN: Do you have a date on that?

CHAIRMAN ZECH: Well, wait a minute now. Would you care to step to the microphone and identify yourself for the reporter so we can hear your answer, please? Thank you.

MR. SCALETTI: My name is Dino Scaletti. I'm with the NRR staff.

We don't have a date for the submittal yet. We expect it to come in sometime in early 1990 --

CHAIRMAN ZECH: Thank you very much.

MR. SCALETTI: -- which it will be in well before the certification begins.

CHAIRMAN ZECH: Thank you.

COMMISSIONER CURTISS: Just a quick question on that subject of maintenance.

CHAIRMAN ZECH: Yes, proceed.

COMMISSIONER CURTISS: I take it what's

envisioned here is that the Japanese into this initiative will lead to a plant that meets all the requirements that we think are important and address all the issues that we think are important and, conversely, the U.S. version of this plant will do the same. The Japanese, as I think we all have seen and known, require their plants to shut down every three months for a periodic required maintenance period.

Two questions. One, do they intend to apply that regulatory regime to this plant? And two, is that something that we are considering as an important and essential regulatory ingredient of the approved process of ABWR?

DR. MURLEY: Let me try to answer. We met with the regulatory authorities in Japan. And my understanding is that they do intend to follow the same regulatory criteria for the advanced BWR as they do for their current plants, which would mean that there be a period of every year where they shut down for a few months and carry out certain defined maintenance activities. They go, of course, further than we do by quite a bit. They tear down their turbines every year as well as certain other equipment.

We are not considering that as a

requirement. I think we're not -- well, I guess I shouldn't go much further than that. It's not clear to us that that is required, as a matter of fact, for good maintenance. It may be possible that their preventive maintenance goes too far in terms of-- beyond what's required. And I think they're thinking that themselves, although they haven't changed to back off a bit because they don't know how far to back off. But in private discussions, they think that maybe tearing down the turbine every year is not required for every instance.

But to answer your question directly, they are still planning, to the best of my knowledge, to adopt those same criteria for this plant and, no, we are not considering that.

COMMISSIONER CURTISS: In that respect, the two initiatives are not complete technical parallels. There are some differences in the requirements that they would impose, perhaps, on the significant issue depending upon how you view the significance of mandatory outages for maintenance.

DR. MURLEY: Yes. The design -- whether it has an impact back in design, that is whether the Japanese maintenance rules and requirements would impact the design such that the design of the Japanese

plant, the Kashuwazaki plant, is different from ours, I don't know.

COMMISSIONER CURTISS: Okay.

CHAIRMAN ZECH: All right. Let's proceed, please.

MR. RUBENSTEIN: And finally, in the set of miscellaneous items that we have, we have the BWR thermal-hydraulic stability, the staff believes that the design eliminates the need for operator action and reduces the potential for exceeding fuel damage limits. This is accomplished by vent operation in the region of least stability being prevented and selected control rod run-in initiated by trip of at least two reactor internal pumps.

COMMISSIONER CARR: Is that an administrative prevention in the first one?

MR. RUBENSTEIN: Yes, primarily. You have to stay out of that section in the power flow mode.

That concludes the specific ABWR design features and if you have no more --

DR. MURLEY: Let me just make sure that this last one is understood. This would preclude, we believe, the type of event that happened at LaSalle in 1987. So it's relatively easy to design out and they believe they have done it.

CHAIRMAN ZECH: All right. We'll proceed.

DR. MURLEY: We'll move on to the conclusions then, Mr. Chairman, that the GE and the NRC staff are in agreement with the approach that we've just described to you on these severe accident issues. The staff believes that its review will confirm the effectiveness of these features in addressing severe accident goals that are defined in 10 C.F.R. Part 52 and Commission's policy papers.

If the review does, in fact, confirm the effectiveness, then the severe accident closure will be achieved for the ABWR. I regard this as highly significant that more than a year before we are to enter into the hearing process for certification, we will have reviewed and settled and agreed, at least on the broad outlines, of the policies associated with severe accidents. And with these policy guidelines in place, then the staff review can move ahead on the details and I think be much more effective.

Of course, the staff will inform the Commission if any additional requirements arise that are necessary to resolve severe accident concerns. We do not see any on the horizon, but there may be some that do arise.

That concludes our briefing.

CHAIRMAN ZECH: All right. Thank you very much.

Any questions from my fellow Commissioners? Commissioner Roberts?

COMMISSIONER ROBERTS: There is an advanced BWR being built in Japan now?

DR. MURLEY: That's right. I should have mentioned, Mr. Chairman, there are plans for two units at the Kashuwazaki site. Their licensing review and regulatory review is moving in parallel with ours and we are working very closely with them, with the authorities in Japan.

Their schedule is that construction will begin in February of 1991. They plan to pour the basemat in July of 1992 and begin commercial operation in 1996. There will be two units. The second unit will follow beyond the first unit a little bit.

COMMISSIONER ROBERTS: Well at this stage will those units essentially be what you've described this morning?

DR. MURLEY: Yes.

COMMISSIONER ROBERTS: I know there's some unresolved less important issues.

MR. RUBENSTEIN: It's essentially yes except for a couple of minor things like turbine orientation

and how they inject water into the core. That's the essential major change.

DR. MURLEY: The major features that we described today, the severe accident features, my understanding is will be in those plants.

MR. RUBENSTEIN: It's a joint design between General Electric, Tobashia and Hatachi.

CHAIRMAN ZECH: Commissioner Carr?

COMMISSIONER CARR: On the equipment that's required to mitigate the severe accident not being safety related, if that's going to run a long time and take care of its intended function, isn't it, in effect, going to be safety related? Won't you have EQ requirements and power supply requirements and earthquake requirements if it's really designed to handle the severe accident?

DR. MURLEY: Well, the intention, Mr. Commissioner, was that we not require these features for low probability events to be what I call gold plated, namely meet all the seismic requirement, single failure proof requirements and so forth that your first line safety systems would have to meet. We didn't really see the need for that.

The short answer to your question is no we don't see them becoming --

COMMISSIONER CARR: I guess my curiosity is if you don't need them when you need them, then you probably don't need them at all? I mean, I can't imagine having to rely on that piece of equipment. I guess what I'm really trying to figure out is why require it at all -- you don't require it, do you? Are you saying you don't require it -- you don't require the equipment?

DR. MURLEY: We're requiring it in the sense that the equipment is -- we expect it to be there. We don't expect that it has the same kind of reliability that we want, for example, for emergency cooling systems and that sort of thing.

COMMISSIONER CARR: I read that as you want it to be there, but you don't expect it to ever be used?

DR. MURLEY: We don't expect it to be used, no. But that, nonetheless, making it single failure proof and gold plating it does not necessary -- it adds a lot to the cost we know. We don't know that it adds all that much to its reliability.

COMMISSIONER CARR: I'm not talking about single failure proof. I'm just talking about having to be used in a long time in a tough environment and--

DR. MURLEY: Let me ask Mr. Thadani to speak

to this because there are some details.

COMMISSIONER CARR: Fine.

MR. THADANI: Again Ashok Thadani.

Commissioner, the intent is clearly that the equipment such as the vent or the fusible plugs or various features to deal with severe accidents, the intent clearly is that they be able to perform their functions in the environment that they are expected to see. That demonstration should be provided. But beyond that, there are many other requirements of safety grade systems that would have really no impact for the kinds of conditions and situations we're discussing.

Dr. Murley pointed to single failure proof consideration, which would require two of the same things, so to speak. It would be one example. Another example you mentioned in the seismic. If the system were required to mitigate some accident scenario for seismic events, then that would be an element in itself because of the very fact that it had to perform its function in that environment. However, if a severe accident comes about because of combinations of failures from internal events, then this system would not be designed to those strict seismic standards and that's really the top process that went

into saying they don't have to be safety grade.

COMMISSIONER CARR: Okay. All right.

CHAIRMAN ZECH: Commissioner Rogers?

COMMISSIONER ROGERS: I understand that you intend to address compliance with the ABWR severe accident requirements on a design specific basis rather than through generic rulemaking for certain practical reasons; to minimize scheduling impacts and such. And what assurance do we have on the Commission that as each issue gets resolved on a design specific basis that we're not drifting into some kind of difference in requirements for different advance reactor designs?

DR. MURLEY: Let me try to answer that. You're correct, Commissioner, it's primarily for scheduling reasons that we're approaching this. But many of the issues would be the same. Of course, hydrogen control will be the same for -- we'll have to address that issue for other plants. ATWS we will have to address.

As we go through the review process, it could very well be that other designs choose to meet the severe accident issue in another way. For example GE has chosen and we've agreed with it, I mean we've kind of encouraged it, that they have over pressure

protection by a vent. It could be that other plants may decide that they can maintain containment integrity without a vent, and we'll have to review that.

So, I guess what I'm saying is that the basic requirement, I think, will stay pretty much the same but how the individual designs choose to meet the requirements may differ as we move through. Now, I recognize this will lead to different certified designs and because the certification is, in itself, a rulemaking, in essence we will have different rules in place that meets the severe accident issue.

I do not see that personally as a major drawback and problem. I think the staff can maintain a consistency in the sense that the basic requirement to address ATWS, to address hydrogen, to address the issues is still there.

COMMISSIONER CURTISS: What you're saying is, do you view the design certification rulemaking as a vehicle strictly to ensure that the applicant complies with existing requirements that are, in turn, generic in nature and set forth in other parts of the regulations or and to set forth any design specific requirements that might be necessary for individual applications?

DR. MURLEY: Well, I would say both. That we expect that the design that goes through certification will meet all the regulations that are on the books for severe accidents unless, of course, there's some feature where we decide to give -- where they get an exemption. We mentioned one today on the ATWS rule. There may be some cases like that if we an agree with them that their reliability is good enough, then there may be some narrow areas of exemptions. But we do expect them to meet the current regulations and we also expect them to meet the severe accident issues that we've defined that go beyond our current regulations.

COMMISSIONER CURTISS: I guess it's the converse of that that I'm concerned about. I didn't mean to interrupt you.

DR. MURLEY: No, that's fine.

COMMISSIONER CURTISS: It's worth pursuing because I did, I guess, see that as the most significant policy question in this paper, the decision to change course really 180 degrees from the recommendation last September in 88-248 to pursue severe accident issues in a rulemaking and now, and for what I thought were a number of very good reasons to do that, and now with very little discussion a

decision that I think is probably the most significant one in this paper, and that is to pursue severe accident in the context of individual design certification step in addition to the concern that Commission Rogers has about the potential for proliferation of different requirements for different plants, Les leaves and somebody comes on board and you get into that design specific review process.

I guess I'm also concerned that the potential exists for the design certification rulemaking to do one of two things. One, to establish a general generic policy that the Commission really is effectively saying we're going to apply to all these. Source term is a good example of that. One of the reasons I'm concerned about what the staff has proposed on source term, differing treatment, or the design certification becomes the vehicle for making what amount to generic changes in existing regulatory requirements. And the one there that occurs to me is the relationship of the operating basis serving with the SSE that was addressed in the last briefing where it looks to me like for the GE plant they're going to decouple those two in a manner that effectively omits Part 100. That's my concern as we say that we're going to approach these issues on a design specific

basis when, in fact, the issues themselves for both DBA and severe accident may well be generic in nature.

DR. MURLEY: I share your concern that we could -- it is possible to drift apart and I think the way to prevent that is close oversight by the Commission as well as close oversight by the staff. I get back to it, it's an issue of timing. I wished we had a severe accident rule, you know, five years or so ago. But we don't, we don't have it and it would be enormously disruptive now to the reviews that have been going underway to stop and to develop a severe accident rule. It could be done. I mean, to me it's clearly a policy question for the Commission. But we are on the path of reviewing these on design specific basis and we're going to do everything we can. And we think we can keep them consistent.

COMMISSIONER ROGERS: Well, I had hoped that you would bring to the attention of the Commission any decisions of that sort, you know, as a package or however, not necessarily one by one, so that we're aware of those as they come up. And from our point of view, we'll have an opportunity to ask that question again from time-to-time.

DR. MURLEY: I think we can do that on a regular basis. We ought to plan on doing that, yes.

COMMISSIONER ROGERS: Just somewhat along these lines, have the safety enhancements that General Electric has offered in their design, are they also reflected in the EPRI advanced light water reactor requirements document or do they exceed the specifications in that guide?

DR. MURLEY: In some cases they exceed them, in other cases they meet them. For example, the one in the area of electrical systems to cope with station blackout, the ALWR requirements document requires an alternate AC combustion turbine generator, which I think the early design of the ABWR did not have, but they decided to agree with it and put it in. So in that sense it meets those requirements.

In other areas, for example in hydrogen, the ABWR essentially side steps the issue because they've gone to inerted containments. And we're having discussions -- I'm having a meeting yet this week with EPRI on what should be the design basis for hydrogen for containments and that there's some -- well we're having disagreements at the staff level, at least, on what that should be.

But in a sense, the ABWR goes beyond that requirement. They have installed a vent to protect for over pressure. That goes beyond the ALWR

requirements document.

COMMISSIONER ROGERS: Well, are we staying in touch with EPRI as we sort of come to decisions on these matters so that they have an opportunity to incorporate them back in their documents?

DR. MURLEY: Yes, we are. This does not set a precedent or a requirement for the EPRI requirements. In fact, some areas they disagree that this has gone too far. So we're still discussing with them what should be the ALWR requirements.

COMMISSIONER ROGERS: Well, I'm just concerned about that they're aware of these?

DR. MURLEY: Oh, yes. Oh, we're in very close contact with them.

COMMISSIONER ROGERS: They can decide however they want, but at least they should have the information as to what our position is.

MR. RUBENSTEIN: We met with EPRI the ACRS subcommittee in Palo Alto about a month ago and we went over these very specifically and they had an opportunity to make their case and, as Dr. Murley said, that they don't necessarily agree with some of the offerings or our decisions and we're going to meet with them again on Thursday.

COMMISSIONER CARR: All right. Good. Good.

MR. MILLER: Commissioner Rogers?

COMMISSIONER ROGERS: Yes.

MR. MILLER: GE has agreed to meet EPRI requirements or state to us where they differ so in the review process we are acutely aware of where the differences occur. Where the differences do not occur, they are in conformance and agreement with the rest of the requirements.

CHAIRMAN ZECH: Commissioner Curtiss?

COMMISSIONER CURTISS: Let me just close the loop on the question that Commissioner Rogers has raised, because I do think it is a significant one and this decision will say a lot about how we review design certification in the future, how we treat issues like severe accident and DBA issues. I guess I remain to be convinced based upon the rather brief discussion in this paper that rulemaking is not the way to go. The staff has talked about the concerns with the schedule, but what I would like to see in more detail, particular in view of the detailed discussion in 88-248 and the two workshops that have been held and the considerable discussion that's gone on, I'd like to see from the staff a more detailed discussion of just what the schedule impacts would be.

The original schedule called for a 17 month

rulemaking, proposed to final in a manner that, at least in September, the staff knew to be compatible with the schedule for review of design certifications. And I guess I'd question what has changed since September of last year and June of this year in terms of a reversal of the position on that.

Secondly, there were benefits that were identified at that time in 88-248 to proceeding by rulemaking, from a legal standpoint, from the standpoint of uniformity which Commissioner Rogers has touched upon and from the standpoint of fleshing out the requirements of the safety goal and severe accident policy statements. And I guess I'd like to reserve judgment on the wisdom of the course that the staff has proposed, albeit in an information paper here to see that kind of discussion and discuss the pros and cons at this point and if there is a sound schedule reason for while we can't proceed, be convinced of that as well.

I do have some particular questions. Source term I've already discussed and I gather we'll be having more detail come in on that.

Just some loose ends that I'll tie up. Has the ACRS reviewed this paper? What's the status of that?

MR. RUBENSTEIN: Yes, they have. We met with them just about a week ago. It was not involved opportunity to review it. We proposed that they may want to consider giving comments and I believe that they decided because of the early nature of the review with the design, that they would not give comments at this time.

COMMISSIONER CURTISS: The question on that is really sort of a tangential question. The ACRS has been tasked to develop containment criteria. Can you explain to me how the ACRS initiative relates to what you've got going on here and in other contexts?

MR. SPEIS: They had a task force in trying to address this issue. Basically the issue is whether we should have a containment criteria that encompasses both design base accidents/severe accidents. And as you heard from the staff today, our approach is kind of truncated. You know, we go forward with design base accidents and then we add margin to make sure that we accommodate the severe accident concerns. And the ACRS, you know, when we talk to them they said, "Well, that makes sense, but maybe it's more -- it makes more sense to do it in a more global way, to come up with precise criteria," because right now the containment criteria, for example, are those that

derive from LOCA from steam line breaks and pressures in the temperatures. And then we'll see if we can add margin to the containment to accommodate augmented pressures and temperatures from severe accidents and the ACRS says, "You know, maybe we should come up with one pressure and temperature to globally consider both design basis and severe accidents."

I'm sorry I drug out the one issue.

COMMISSIONER CURTISS: Well, I guess the question that I have is it appears to me that there's some potential for conflict. You all, I take it, have made the decision that this plant could be licensed with hardened vent 45 PSI and the size of the wetwell volume that you've got. Where are we if the ACRS comes in and says we ought to have 60 PSI, we shouldn't have a hardened vent mass reactor, we should have a larger wetwell volume? Where are with this initiative at that point?

MR. SPEIS: I don't feel what we're talking with the ACRS will effect that basically. And as I said earlier, the ACRS didn't see anything wrong with what we're doing, but they wanted to study this some more and --

DR. MURLEY: Excuse me. But a direct answer, though, Mr. Commissioner, is if they come in

with a fundamental difference like that it will ultimately wind up at this table, I'm sure, the Commissioner's. But we'll do our best to work with them to accommodate their concerns and so forth. But if there is a fundamental design change like that, then it could well wind up with the Commission.

COMMISSIONER CURTISS: Okay. One final question. On the performance criteria that GE has set out to meet here, do you have any feel for whether you think they can meet those when external events are factored, given the numbers that we're seeing on external events?

MR. RUBENSTEIN: We've seen some very preliminary numbers and we've only had the PRA for about a month now and just taking from a presentation that they gave us, we believe they can.

COMMISSIONER CURTISS: Okay.

DR. MURLEY: But I think until we see the details, we can't answer that for sure.

MR. RUBENSTEIN: Again, it's a summary table and the summary table clearly showed that it met it with the over pressure protection capability.

COMMISSIONER CURTISS: Okay. That's all I have.

CHAIRMAN ZECH: Well, it does seem to me

that a paper on the status of the source term work would probably be appropriate, as we mentioned earlier in the meeting. And perhaps after that paper comes to the Commission, the Commission would like to consider a meeting to discuss it.

DR. MURLEY: Yes, sir.

CHAIRMAN ZECH: And frankly, I agree with the staff's approach toward the severe accident in this ABWR design and I commend the staff on their work towards certification of an advanced light water reactor. I'd also commend General Electric Company for their leadership role in bringing forth the lead advanced light water reactor design for certification.

I agree with my colleagues that it would be important to try to bring forth the convergence of the generic rulemaking on severe accidents at the appropriate time to realize the full benefits of standardization. I think that's the right the thing to do. On the other hand, I really do believe that the efforts can be done in parallel and that we can continue with your efforts along the ABWR certification process and not stop the progress you've made. I think that would be a mistake, personally, to do that. But I do agree that we should do what we can to work towards a rulemaking.

I personally feel that what you're doing in the ABWR effort could really contribute to a better rulemaking. It would give us experience to work in this area mindful of the plant specific requirements of this design would also -- I don't think they need be incompatible with what we'd want to do for a generic rulemaking. So it seems to me that you should continue to do what you're doing as regards this certification process and certainly not hold it up, that would be my approach, and wait for generic rulemaking.

Generic rulemaking, of course, as we all know would have been nice to have in place right now. We don't have it in place. I don't think -- it doesn't -- wouldn't bother me, though, to go in a parallel effort in this regard recognizing that we do eventually want to get to a generic rulemaking that would, again, realize the full benefits of the Part 52 effort that we've made and standardization program and so forth. But I would certainly recommend that the Commission not bring a halt to this very important effort that really is the lead effort towards a certified design and, as far as nuclear energy and our country for the future is concerned, it has to be viewed upon as a very important effort.

COMMISSIONER CURTISS: Let me add I agree with what the Chairman has said. I didn't mean to leave the impression that I think we ought to in any way slow down this effort. I think the schedule that you have adhered to is a remarkable testament to the close work that you've undertaken and the commitment of the staff and I really -- is one of the few instances where the schedule's really stuck as we've had each of our individual briefings. And I want to commend you all for that.

I do think the Chairman's suggestion to take a look at the parallel effort with an objective--having a severe accident rulemaking of a generic nature would address a number of the concerns that I have and is a sound suggestion.

MR. TAYLOR: Mr. Chairman, the staff is discussing actively in this evolutionary phase based upon our current regulations and then these changes like in the ABWR being sure our current regulations are revised if necessary, cleaned up for the evolutionary designs. Then we're talking about what about the advanced light water reactor and so on. So the staff is in parallel with this effort to take this design that GE has worked up concerning with bringing the rulemaking efforts in parallel.

CHAIRMAN ZECH: Good. I think it's --

MR. TAYLOR: To struggle with this both-- there's some things that should be changed and we've talked about that with the Commission. So we are not -- we continue to be conscience of the necessity to get our rules updated.

CHAIRMAN ZECH: Good. Well, I think it's important that we continue that effort.

MR. TAYLOR: And the advanced light water reactor designs will be a whole different approach. We're very happy to see this treatment of severe accident since we're struggling with the existing plants on that, and that's the -- GE has done a very fine job, as you have said, trying to address these issues.

CHAIRMAN ZECH: All right. Thank you.

Well, I do think it's important that you continue that effort.

Well, let me thank the staff for this important briefing today on the status of application of the severe accident policy to the standard plant design. As the staff knows, the Commission is very supportive of the standardization initiatives and strongly supports your work in this area. Advanced boiling water reactor along with the other advanced

design that we're aware that are underway are all very important initiatives as they directly relate to the future use of nuclear power in our country. I'd encourage the staff to continue to work closely with all of the vendors of these advanced designs and to address and resolve as best you can all the technical and safety issues that are so important to the certification process and to the mission of our agency. Many of them involve the severe accident issues and challenges that we've talked about here today. It's important that we continue work in that area, I believe, in order to ensure that these advanced designs are the best that can be designed using the experience we have in these many years of operation of commercial nuclear power plants in our country.

So I'd also encourage the staff to continue to keep the Commission advised in the review of these new applications and the criteria that are so very important to the eventual, perhaps, approval and licensing process that could be foreseen in the future.

We do need to evaluate the generic nature of all the issues and I appreciate the fact that you're continuing to work in a parallel effort in that

regard.

But thank you very much for a very important briefing and for your efforts that you've made towards providing really a future for nuclear energy in our country in these advanced designs and the certification process that you're working on so hard and so effectively.

Are there any other questions or comments by my fellow Commissioners? If not, thank you very much for an excellent briefing.

We stand adjourned.

(Whereupon, at 11:32 a.m., the public hearing was adjourned.)

CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON THE APPLICATION OF THE SEVERE ACCIDENT POLICY TO THE LEAD APPLICATION FOR ADVANCED LIGHT WATER REACTORS

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: JUNE 20, 1989

were transcribed by me. I further certify that said transcription is accurate and complete, to the best of my ability, and that the transcript is a true and accurate record of the foregoing events.

Reporter's name: Miles Anderson

ABWR SEVERE ACCIDENT DESIGN

PURPOSE

TO INFORM THE COMMISSION OF CERTAIN FEATURES OF GENERAL ELECTRIC'S ABWR THAT STAFF BELIEVES WILL ENHANCE SAFETY AND WILL SATISFACTORILY ADDRESS SEVERE ACCIDENT CONCERNS UPON COMPLETION OF THE STAFF'S REVIEW.

TOPICS OF DISCUSSION

- STATION BLACKOUT
- INTERSYSTEM LOCA
- ANTICIPATED TRANSIENT WITHOUT SCRAM (ATWS)

TOPICS OF DISCUSSION (CONT'D)

- CONTAINMENT
  - ° ABWR DESIGN GOAL
  - ° HYDROGEN CONTROL
  - ° VENTING
  - ° CORE DEBRIS COOLABILITY
- SOURCE TERMS
- PROBABILISTIC RISK ASSESSMENT (PRA)
- BWR THERMAL-HYDRAULIC STABILITY
- CONCLUSION

STATION BLACKOUT

- DESIGN GOES BEYOND STATION BLACKOUT RULE
- THREE INDEPENDENT ELECTRICAL DIVISIONS
- THREE 100% CAPACITY DIESEL GENERATORS
- ALTERNATE AC COMBUSTION TURBINE GENERATOR
- 10 HOUR BLACKOUT PERIOD SURVIVABILITY UTILIZING RCIC AND STATION BATTERIES
- AC INDEPENDENT WATER ADDITION SYSTEM

STATION BLACKOUT (CONT'D)

- ABWR PROVIDES SIGNIFICANTLY LOWER RISK FROM STATION BLACKOUT COMPARED TO PREVIOUS BWR DESIGNS

INTERSYSTEM LOCA

- NEED TO ELIMINATE CONCERN ABOUT LOCA OUTSIDE CONTAINMENT
- ECCS INBOARD CHECK VALVES ARE TESTABLE AND HAVE POSITION INDICATION
- ABWR LOW PRESSURE SYSTEMS ARE ADEQUATELY PROTECTED FROM REACTOR COOLANT SYSTEM PRESSURE
- INTERSYSTEM LOCA RESOLVED FOR THE ABWR

ANTICIPATED TRANSIENT WITHOUT SCRAM

- BOTH HYDRAULIC AND ELECTRIC ROD CONTROL
- RECIRCULATION PUMP TRIP
- SCRAM DISCHARGE VOLUME ELIMINATED
- ALTERNATE ROD INJECTION
- MANUAL STANDBY LIQUID CONTROL SYSTEM (SLCS) (VS. AUTOMATIC IN ATWS RULE)
- IF MANUAL SLCS IS ACCEPTABLE, THE STAFF WILL RECOMMEND AN EXEMPTION FROM ATWS RULE

CONTAINMENT

ABWR DESIGN GOAL

- CONDITIONAL CONTAINMENT FAILURE PROBABILITY 10^{-1} OVER CREDIBLE CORE DAMAGE SEQUENCES
- CONTAINMENT FAILURE DEFINED AS UNCONTROLLED RELEASE
- SEQUENCE STARTS WITH ONSET OF CORE DAMAGE

CONTAINMENT (CONT'D)

HYDROGEN CONTROL

- NITROGEN INERTED CONTAINMENT ATMOSPHERE
- HYDROGEN RECOMBINER CAPABILITY
- ABWR HYDROGEN CONTROL FEATURES ARE ACCEPTABLE

CONTAINMENT (CONT'D)

VENTING

- "HARDENED" WETWELL VENT
- VENT OPERATION AC INDEPENDENT
- INCLUDES RUPTURE DISKS

CONTAINMENT (CONT'D)

CORE DEBRIS COOLABILITY

- SUPPRESSION POOL ELIMINATES CONTAINMENT LINER DEGRADATION PROBLEM
- DESIGNED TO ENHANCE CORE DEBRIS COOLABILITY
- DESIGN ELIMINATES SUPPRESSION POOL FISSION PRODUCT BYPASS

CONTAINMENT (CONT'D)

CORE DEBRIS COOLABILITY (CONT'D)

- DO NOT EXPECT CONTAINMENT FAILURE BY MELT THROUGH

SOURCE TERM

- LICENSING BASIS CONTINUES TO BE 10 CFR PART 100 SITING CRITERIA WITH ITS ASSOCIATED SOURCE TERM (TID 14844)
- ASSUMES CREDIT FOR CERTAIN DESIGN FEATURES UNDER DISCUSSION WHICH GE BELIEVES CAN BE JUSTIFIED

SOURCE TERM (CONT'D)

- MORE REALISTIC SOURCE TERM TO BE USED TO DEMONSTRATE GE SAFETY GOAL CAN BE ATTAINED
- SAFETY GOAL:

  PROBABILITY OF OFFSITE DOSE

  25 REM BEYOND 1/2 MILE FROM REACTOR

  10^{-6}/YEAR

PROBABILISTIC RISK ASSESSMENT (PRA)

- LEVEL-3 INTERNAL/EXTERNAL EVENTS PRA
- GE TO PROVIDE RELIABILITY AND MAINTENANCE CRITERIA TO ENSURE THAT AS-BUILT DESIGN DESCRIBED BY CERTIFIED DESIGN IS MAINTAINED
- APPLICATION TO INCLUDE KEY ASSUMPTIONS AND COMMITMENTS OF PRA

BWR THERMAL-HYDRAULIC STABILITY

- PLANT OPERATION IN REGION OF LEAST STABILITY PREVENTED
- SELECTED CONTROL ROD RUN-IN INITIATED UPON TRIP OF AT LEAST TWO REACTOR INTERNAL PUMPS
- DESIGN ELIMINATES THE NEED FOR OPERATOR ACTION AND REDUCES POTENTIAL FOR EXCEEDING FUEL DAMAGE LIMITS

CONCLUSIONS

- GE AND STAFF IN AGREEMENT WITH APPROACH TO SEVERE ACCIDENT CONCERNS
- STAFF BELIEVES ITS REVIEW WILL CONFIRM EFFECTIVENESS OF THESE FEATURES IN ADDRESSING SEVERE ACCIDENT GOALS DEFINED IN 10 CFR PART 52 AND THE COMMISSION'S POLICY PAPERS

CONCLUSIONS (CONT'D)

- IF EFFECTIVENESS IS CONFIRMED, SEVERE ACCIDENT CLOSURE WILL BE ACHIEVED FOR THE ABWR
- STAFF WILL INFORM COMMISSION IF ADD'L REQUIREMENTS NECESSARY TO RESOLVE SEVERE ACCIDENT CONCERNS